"A COMPARATIVE STUDY ON EFFICACY OF VENTILATORY MUSCLE STRENGTH TRAINING AND VENTILATORY MUSCLE ENDURANCE TRAINING ON IMPROVING WORK CAPACITY IN COPD PATIENTS"

Dissertation submitted to

THE TAMIL NADU DR. M. G. R. MEDICAL UNIVERSITY,

Chennai-32

towards partial fulfillment of the requirements of

MASTER OF PHYSIOTHERAPY

Degree programme

SUBMITTED BY

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CERTIFICATE I

This is to certify that the project work entitled **"A COMPARATIVE STUDY ON EFFICACY OF VENTILATORY MUSCLE STRENGTH TRAINING AND VENTILATORY MUSCLE ENDURANCE TRAINING ON IMPROVING WORK CAPACITY IN COPD PATIENTS."** was carried out by **Reg.No.27092328, P.P.G. COLLEGE OF PHYSIOTHERAPY**, Coimbatore-35, affiliated to **THE TAMILNADU Dr.M.G.R.MEDICAL UNIVERSITY**, Chennai-32, under the guidance of **Prof.M.HARIRAJA., M.P.T (cardio)., MIAP.**

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Principal

CERTIFICATE II

This is to certify that the dissertation work **" A COMPARATIVE STUDY ON EFFICACY OF VENTILATORY MUSCLE STRENGTH TRAINING AND VENTILATORY MUSCLE ENDURANCE TRAINING ON IMPROVING WORK CAPACITY IN COPD PATIENTS."** was carried out by **Reg.No.27092328, P.P.G. COLLEGE OF PHYSIOTHERAPY** Coimbatore-35, affiliated to **THE TAMILNADU DR. M. G. R. MEDICAL UNIVERSITY,** Chennai-32, under my Guidance and direct supervision.

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professor

CERTIFICATE III

This is to certify that the dissertation work **" A COMPARATIVE STUDY ON EFFICACY OF VENTILATORY MUSCLE STRENGTH TRAINING AND VENTILATORY MUSCLE ENDURANCE TRAINING ON IMPROVING WORK CAPACITY IN COPD PATIENTS."** was carried out by **Reg.No.27092328, P.P.G. COLLEGE OF PHYSIOTHERAPY** Coimbatore-35, affiliated to **THE TAMILNADU DR. M. G. R. MEDICAL UNIVERSITY,** Chennai-32, under my Co- Guidance.

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First and foremost I praise and thank **OMNIPONTENT GOD** for his gracious showers of blessings upon me that has shaped me.

I bow myself as a note of love and gratitude before **MY PARENTS** for their caring that has made me what am today; its my blessing to have them.

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THE DISSERTATION ENTITLED

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I express my thanks to each and every **PATIENT** who cooperated to fulfill this project work possible.

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A COMPARATIVE STUDY ON EFFICACY OF VENTILATORY MUSCLE STRENGTH TRAINING AND VENTILATORY MUSCLE ENDURANCE TRAINING ON IMPROVING WORK CAPACITY IN COPD PATIENTS

ABSTRACT

Objective: To compare the efficacy of Ventilatory muscle strength training with Ventilatory muscle endurance training on improving the work capacity in COPD patients.

Design: The study is a two group experimental study design with pre-test and post-test evaluation**.**

Method: Sixty patients aged 30 to 55 years with COPD were selected on the basis of inclusion and exclusion criteria and assigned into two groups with 30 patients each,for control and experimental group based on non-probability purposive sampling technique.Control group received Ventilatory muscle strength training and experimental group received Ventilatory muscle endurance training for a period of 4 weeks.

Outcome measure :Modified Borg scale is used to evaluate the work capacity before and after the treatment.

Results: Statistical analysis done by using student 't' test showed that there was significant improvement in patients who received Ventilatory muscle endurance training than patients who received ventilatory muscle strength training.

Conclusion : Hence, it can be concluded that Ventilatory muscle endurance training shows significant improvement on work capacity than Ventilatory muscle strength training in COPD patients.

CHAPTER I

INTRODUCTION

1.1 INTRODUCTION

“Breathing is the basic rhythm of life”

[Hippocrates]

Chronic obstructive pulmonary disease (COPD) is defined as a disease characterized by progressive airflow limitation that is not fully reversible and is associated with an abnormal inflammatory response of lungs to noxious particles of gases primarily cigarette smoking.

Chronic obstructive pulmonary disease (COPD), also known as chronic obstructive lung disease (COLD), chronic obstructive airway disease (COAD), chronic airway limitation (CAL) and chronic obstructive respiratory disease (CORD), refers to chronic bronchitis and emphysema, a pair of commonly co existent diseases of the lungs in which the airways become narrowed.

Worldwide, Chronic obstructive pulmonary disease (COPD) ranked as the sixth leading cause of death in 1990. It is projected to be the fourth leading cause of death worldwide by 2030 due to an increasing smoking rates and demographic changes in many countries.

Chronic obstructive pulmonary disease (COPD) is the fourth leading cause of death in United States. Globally males are most commonly affected when compared to females.

Chronic obstructive pulmonary disease (COPD) occurs in 34 out of 1000 people. In the most socio economically deprived parts of in the country, 1 in 32 people were diagnosed with chronic obstructive pulmonary disease (COPD), compared with 1 in 98 in the most affluent areas.

In United States, the prevalence of chronic obstructive pulmonary disease (COPD) is approximately 1 in 20 or 5% people in United States of America.

Rene Laennec the physician, who invented the stethoscope, used the term “emphysema” in this book "A Treatise on the disease of the chest and of mediate auscultation" (1837), to describe the lungs that did not collapse.

The term COPD was first used by **William Briscoe** in 1965 and has gradually overtaken other terms to become established today as the preferred name for this disease.

The term chronic bronchitis and emphysema were formally defined at the CIBA gust symposium of physicians in 1959.

Traditionally, Physiotherapy plays a vital role to improve the work capacity in treating COPD patients.

Recent advances by ventilatory muscle endurance training and Ventilatory muscle strength training will give some more benefits to these patients to improve the work capacity in COPD patients. We need to do further research study on the effectiveness of ventilatory muscle strength training and ventilatory muscle endurance training to do the betterment for these patients.

Thus, the present study intended to compare the effectiveness of ventilatory muscle strength training with ventilatory muscle endurance training on improving work capacity in COPD patients, may facilitate to find out the most effective treatment to improve the quality of life, which helps them get back to normal and may be a added literature for future research studies.

1.2 NEED FOR THE STUDY

The study of chronic obstructive pulmonary disease (COPD) is a respiratory clinical condition which when not treated eventually leads to respiratory failure.

Chronic obstructive pulmonary disease (COPD) is defined as a disease characterized by progressive airflow limitation that is not fully reversible and is associated with an abnormal inflammatory response of lungs to noxious particles of gases primarily cigarette smoking.

Chronic obstructive lung disease (COPD) globally affects enormous population and decreases the quality of life individually to the extreme level.

Many techniques are applied on COPD patients to eliminate dyspnoea. This study focuses on Diaphragmatic breathing exercise and pursed lip breathing which are used to increase the strength and endurance of the ventilatory muscles. These technique emphasizes on improving the work capacity of lungs and alleviating dyspnoea, ultimately to improve the quality of life.

Hence, there is a need to perform a study on comparing the effectiveness of ventilatory muscle strength training (VMST) with ventilatory muscle endurance training (VMET) on improving work capacity in chronic obstructive lung disease (COPD) patients.

1.3 OPERATIONAL DEFINITIONS

CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD):

Chronic obstructive lung disease (COPD) is a progressive disease primarily affects the lungs. This is characterized by irreversible airflow limitation and on abnormal inflammatory response to noxious inhaled stimuli.

Michael Russell

DIAPHRAGMATIC BREATHING EXERCISE:

Diaphragmatic breathing exercise is designed to retain the muscles of respiration, improve (or) redistribute ventilation, lessen the work of breathing and improve gas exchange and oxygenation.

Carolyn Kisner,

Therapeutic Exercise.

PURSED LIP BREATHING EXERCISE:

Pursed-Lip Breathing exercise is a breathing technique designed to help you control shortness of breath. It can be particularly useful to COPD patients.

Simon kendal

MODIFIED BORG SCALE:

A system for scoring the perception of dyspnoea, consisting of a linear scale ranking the degree of difficulty in breathing, ranging from none–0 to maximum–10

Chest medicine

1.4 AIM OF THE STUDY

The aim of the study is to compare the effectiveness of Ventilatory muscle strength training (VMST) and Ventilatory muscle endurance training (VMET) on improving work capacity in COPD patients.

1.5 OBJECTIVES OF THE STUDY

- To study the effectiveness of Ventilatory muscle strength training on improving the work capacity in COPD patients.

- To study the effectiveness of Ventilatory muscle endurance training on improving the work capacity in COPD patients.

- To compare the effectiveness of Ventilatory muscle strength training and Ventilatory muscle endurance training on improving the work capacity in COPD patients.

1.6 HYPOTHESIS

- **NULL HYPOTHESIS**

There is no significant difference between the Ventilatory muscle strength training and Ventilatory muscle endurance training on improving the work capacity in COPD patients.

- **ALTERNATIVE HYPOTHESIS**

There is significant difference between the Ventilatory muscle strength training and Ventilatory muscle endurance training on improving the work capacity in COPD patients.

CHAPTER II

REVIEW OF LITERATURE

1. **Journal of Respiration.(2010 July 17)**

   It states that Pursed-Lip Breathing improves the Inspiratory Capacity in Chronic Obstructive Pulmonary Disease.

2. **Spahija J (2010)**

   He emphasized the factors discriminating pursed lip breathing use in patients with COPD.

3. **Al-shair K et al(2009)**

   Concluded that Borg's scale rate of perceived exertion provides a simple, reliable and valid measurement of total and dimensional breathlessness in patients with COPD.

4. **Clinical Rehabilitation, (2008)**

   It states that there is influence of spontaneous pursed lips breathing on walking endurance and oxygen saturation in patients with moderate to severe chronic obstructive pulmonary disease.

5. **Nield MA et al., (2007)**

   He found out that pursed lip breathing has been a breathing pattern retaining strategy for dyspnoea reduction thereby improving work capacity.

6. **Norman H Edelman, MD, (2006)**

   Suggested that "people with emphysema have very collapsible airways, "says Normal H, Edelman, MD". If you teach them to breathe in normally but breathe out through a narrow orifice of their lips, they keep the pressure up in their airways and it tends to prevent the large airways from collapsing.

7. **Davidson., (2005)**

It enumerates that the airflow obstruction which fluctuates markedly causes mismatch of alveolar

entilation and perfusion and increases the work of breathing.

8. **Criner, (2005)**

Conducted a study on COPD patients with advanced emphysema, pursed lip breathing can also open up airways enough to release more air, Criner says, "That may allow some air that's trapped in the lungs to exhale out, so it decreases the amount of gas trapped in your chest,".

9. **Galen chan et.al., (2005)**

They proposed that it is a chronic slowly progressive disorder characterized by airflow obstruction that does not change markedly over several months.

10. **Spahija J (2005)**

They elicited that pursed lip breathing has a variable effect on shortness of breath in patients with COPD.

11. **Visser FJ, et al (2005)**

The researchers reported that inspiratory capacity (the maximum of volume of air inhaled by the lungs from a fully expired state) increased significantly in the 35 severe COPD patients tested during the study.

12. **Garrod R, Daly et al (2004)**

They emphasize the effect of pursed lip breathing decreases post-exercise respiratory rate and improves work capacity in COPD patients.

13. **Criner, (2004)**

Suggested that experts told WEBMD that no evidence supports the value of diaphragmatic breathing. Once patients stop doing the exercise, they revert back to their usual way of breathing.

14. Carolyn kisner et.al., (2003)

Stated that Pursed lip breathing is helpful in COPD patients with a great deal of dyspnea by decreasing respiratory rate, increasing lung volume, improving work capacity and exercise tolerance.

15. Faager G, et al. (2002)

They found a better result in one recent study, 32 COPD patients who used pursed-lip breathing immediately before walking boosted the time they were about to walk before fatiguing by 16%.

16. San Diego et.al., (2000)

They stated that BORG'S SCALE is a valid and reliable assessment tool for dyspnoea. This study demonstrated that it correlated well with other clinical parameters and could be useful when assessing and monitoring outcomes in patients with COPD.

17. Vittacca et.al (1999)

They performed a study and finalized that Diaphragmatic breathing is associated with improved blood gases but increased the work of breathing in patients with severe COPD.

18. Champaign (1998)

He suggested that it is simple method of rating perceived exertion (RPE) and can be used by coaches to gauge an athlete's level of intensity in training and competition.

19. Elizabeth dean., (1996)

She stated that breathing through narrowed airways contributes to wheezing, rapid shallow breathing, and increased work of breathing and decreased alveolar ventilation.

20. Tucker and Jenkins et.al.,(1996)

Concluded that Diaphragmatic breathing exercise help in ree-xpanding collapsed airway and to mobilize secretions.

21. Gosselink RAAM (1995)

In his study, he concluded that diaphragmatic breathing reduces the efficiency of breathing in patients with COPD.

22. Webber and Pryor.,(1993)

Stated that diaphragmatic breathing exercise mobilizes mucus plugs allowing improved ventilation to the peripheral areas thereby reducing dyspnoea.

23. Girodo et al., (1992)

They showed simple relaxed diaphragmatic breathing can reduce the symptoms gradually in COPD patietnts.

24. Karla R.Kendrick, Robert M.Smith, MD (1990)

They established the modified 0-10 Borg scale is used in assessing the degree of dyspnoea in patients with COPD and asthma.

25. Gunnar Borg (1980)

He devised and found out that Borg Scale is a method to measure a person's perceived exertion rate. Developed by Stockholm University Professor Gunner Borg during the 1980s, the scale does not require any equipment, but asks participants who engage in physical activity to assess his or her perceived rate of exertion from light to strenuous.

26. Borg G (1970)

"Perceived Exertion is an indicator of somatic stress". Scandinavian journal of Rehabilitation Medicine

27. University of Maryland Medical Center (1970)

Proved that pursed lip Breathing exercise is particularly useful for people with impaired lung function to engage in before doing strenuous activities.

CHAPTER III

MATERIALS AND METHODOLOGY

3.1 MATERIALS

- Couch
- chair
- Pillows
- Assessment chart
- Copy of Modified Borg scale sheet
- Sputum box
- Face mask
- Foot stool

3.2 METHODOLOGY

3.2.1. STUDY DESIGN

An experimental study design with pretest and post test evaluation.

3.2.2. SAMPLING TECHNIQUE

Non-probability purposive sampling technique.

3.2.3. SAMPLE SIZE

60 patients.

3.2.4. STUDY METHOD

Patients were divided into control group and Experimental group .

CONTROL GROUP :

30 patients were treated with Ventilatory muscle strength training. [VMST]

EXPERIMENTAL GROUP:

30 patients were treated with Ventilatory muscle endurance training. [VMET]

3.2.5 SELECTION CRITERIA

Inclusion Criteria

- Patients with COPD
- Age between 30 to 55 years
- Gender both males and females
- Chronic bronchitis
- Emphysema
- Bronchial asthma

Exclusion Criteria

- Chest infections
- Malignancy of lungs
- Flail chest
- Rib fractures
- Diabetes mellitus
- Cardiac conditions
- Gastro-esophageal reflux
- Hereditary

3.2.6. STUDY SETTING

Ashwin Multi speciality Hospital, Coimbatore.

Kovai respiratory care center,Coimbatore.

3.2.7. STUDY DURATION

The study was conducted for a period of 6 months

3.2.8. PARAMETER

Modified Borg scale

3.2.9. STATISTICAL TOOLS

Intra group analysis:

Statistical analysis is done by using Paired‘t’ test

$$t = \frac{\bar{d}\sqrt{n}}{s}$$

$$s = \sqrt{\frac{\sum d^2 - \frac{(\sum d)^2}{n}}{n-1}}$$

$\bar{d}$ = difference between the pre-test and post test values

d = mean difference

n= number of observations

s = standard deviation

To compare Control Group and Experimental Group:

Statistical analysis is done by using Independent 't' test

$$t = \frac{\overline{x_1} - \overline{x_2}}{S} \sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

$$S = \sqrt{\frac{\sum (\overline{x_1} - x_2)^2 + \sum (\overline{x_2} - x_2)^2}{n_1 + n_2 - 2}}$$

$\overline{x_1}$ = mean value of group I

$\overline{x_2}$ = mean value of group II

n_1= number of observations in group I

n_2= number of observations in group II

S = combined standard deviation

3.2.10. TREATMENT TECHNIQUE

CONTROL GROUP

VENTILATORY MUSCLE STRENGTH TRAINING

Ventilatory muscle strength training was performed by giving Diaphragmatic breathing exercise.

DIAPHRAGMATIC BREATHING EXERCISE

Principles of Diaphragmatic Breathing Exercise:

- Explain the patient about the aims and rationale of breathing exercise.
- Prepare the patient in a relaxed comfortable position such as a semi fowler's position (Reclined sitting) knee will be semi flexed and supporting the legs with pillow, abdominal muscles relaxed and loosen the restrictive clothing.
- Observe the patients natural breathing pattern while rest and in activity.
- Demonstrate the breathing exercise pattern to the patient , never allow the patients to forcefully expire, expiration is relaxed and passive.
- Advice the patient, not to use accessory muscles and upper chest to initiate inspiration.
- Teach the patient, the correct breathing pattern in a variety of positions at rest and in activity.

Procedure:

- Prepare the patient in a relaxed and comfortable position such as sitting in half lying position and with shoulder relaxed and upper chest quiet.
- Place the pound hand over rectus abdominis just below the lateral costal margin.
- Ask the patient to breathe in slowly and deeply through the nose, allowing the abdomen to rise.
- Then, tell the patient to slowly let all the air out through mouth using controlled expiration.
- Ask the patient to practice this technique for 5 to 15 minutes, 5 to 6 times a day with frequent rest.

EXPERI MENTAL GROUP

VENTILATORY MUSCLE ENDURANCE TRAINING

Ventilatory muscle endurance training was performed by giving Pursed lip breathing exercise.

PURSED LIP BREATHING EXERCISE

- Prepare the patient in a relaxed and comfortable position such as sitting in half lying position and with shoulder relaxed and upper chest quiet.
- Ask the patient to inhale slowly through nose until the lungs fill up with air.
- Then ask the patient to purse the lips as if he\she were going to whistle.

- Then patient breathes out slowly while keeping the lips pursed.
- Take twice as long to breathe out as did to breathe in.
- Ask the patient not to force lungs to empty. Ask the patient to practice this technique for 5 to 15 minutes, 5 to 6 times a day with frequent rest.

3.2.11. STUDY PROCEDURE

After getting informed consent , checking inclusion and exclusion criteria under purposive sampling technique, 60 subjects were selected and randomly assigned into control group and experimental group with 30 subjects in each group.

control group was treated with Ventilatory muscle strength training . Experimental group was treated with Ventilatory muscle endurance training . The patient is asked to practice the technique for 15 minutes , 5 to 6 times day with 15 repititions for each session. Pretest and posttest assessment were done for both groups and the values of Modified Borg Scale are measured and tabulated, analyzed using 't' test and tested for significance.

CHAPTER-IV

DATA PRESENTATION

TABLE I

Pre-test and Post-test values of control group (**ventilatory muscle strength training**) using Modified Borg scale

S.NO	PRE-TEST	POST-TEST
1	7	6
2	9	7
3	7	4
4	9	5
5	8	5
6	9	6
7	7	4
8	8	3
9	7	2
10	8	5
11	9	6
12	7	3
13	9	2
14	5	2
15	9	6
16	8	5
17	9	6
18	7	4
19	6	2
20	9	5
21	9	6
22	7	3
23	6	5
24	9	6
25	7	5
26	9	5
27	7	3
28	9	5
29	8	4
30	8	6

TABLE II

Pre-test and Post-test values of Experimental group **(ventilatory muscle endurance training)** using Modified Borg Scale

S.NO	PRE-TEST	POST-TEST
1	8	3
2	9	2
3	7	3
4	9	4
5	8	3
6	8	2
7	9	3
8	9	4
9	8	6
10	5	2
11	9	3
12	8	4
13	6	3
14	9	4
15	8	5
16	9	4
17	8	3
18	9	4
19	9	2
20	8	3
21	7	4
22	6	3
23	8	3
24	9	4
25	9	3
26	8	4
27	9	3
28	9	3
29	8	2
30	9	3

CHAPTER V

DATA ANALYSIS AND INTERPRETATION

TABLE III

ANALYSIS OF PRE TEST DATA OF CONTROL GROUP AND EXPERIMENTAL GROUP

TESTS	CONTROL GROUP	EXPERIMENTAL GROUP
Pre test mean value	7.86	8.16
Independent 't' test	1.05	
P value and its significance	P value > 0.05 and is insignificant	

For 58 degrees of freedom at 5% level of significance, the calculated Independent 't' test for pre test values between Control group and Experimental group was 1.05 and the critical value was 1.960, which states that there is no significant difference between two groups.

GRAPH-I

ANALYSIS OF PRE-TEST VALUES OF CONTOL GROUP AND EXPERIMENTAL GROUP

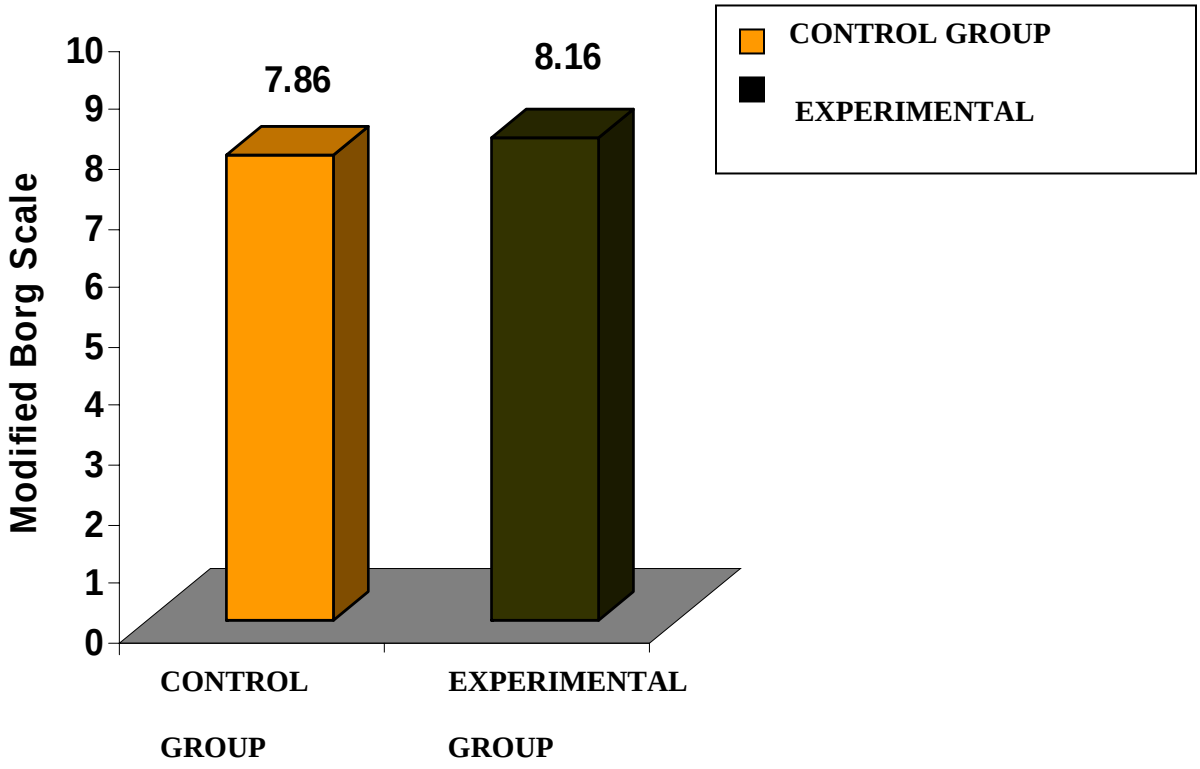


TABLE IV

ANALYSIS OF POST-TEST DATA OF CONTROL GROUP AND EXPERIMENTAL GROUP

TESTS	CONTROL GROUP	EXPERIMENTAL GROUP
Post test mean value	4.53	3.3
Independent 't' test	3.720	
P value and its significance	P value < 0.05 and is significant	

For 58 degrees of freedom at 5% level of significance, the calculated Independent 't' test for post test values between Control group and Experimental group was 3.720 and the critical value was 1.960, which states that there is significant difference between two groups.

GRAPH-II

ANALYSIS OF POST-TEST VALUES OF CONTROL GROUP AND EXPERIMENTAL GROUP

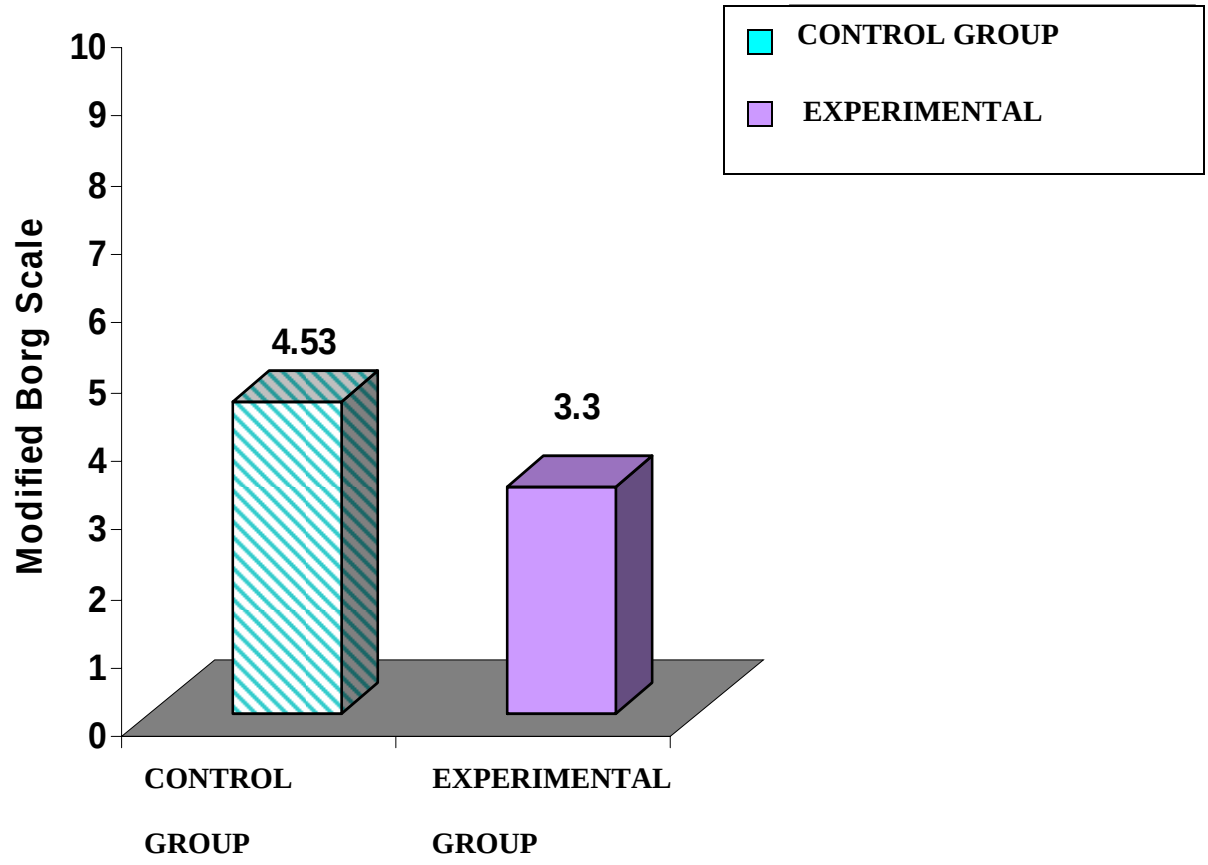


TABLE V

ANALYSIS OF PRETEST AND POST-TEST DATA OF CONTROL GROUP

TESTS	VENTILATORY MUSCLE STRENGTH TRAINING	
Control group	Pre test mean value	Post test mean value
	7.86	4.53
Paired 't' test	14.22	
P value and its significance	P value < 0.05 and is significant	

For 29 degrees of freedom at 5% level of significance, the student 't' test value for control group was 14.22 and the critical value was 2.045, which states that there exists significant difference between the pre test and post test values of Control group .

GRAPH-III

ANALYSIS OF PRE-TEST AND POST-TEST VALUES OF

CONTROL GROUP

[VENTILATORY MUSCLE STRENGTH TRAINING]

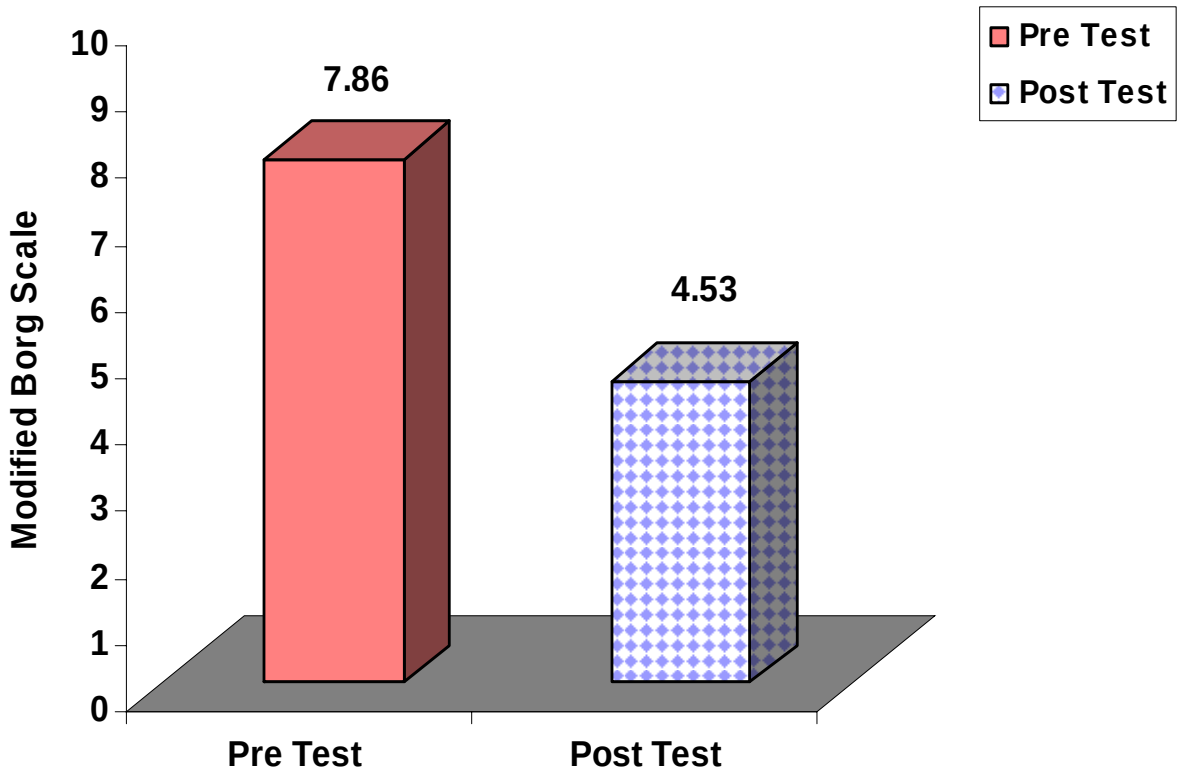


TABLE VI

ANALYSIS OF PRETEST AND POST-TEST DATA OF EXPERIMENTAL GROUP

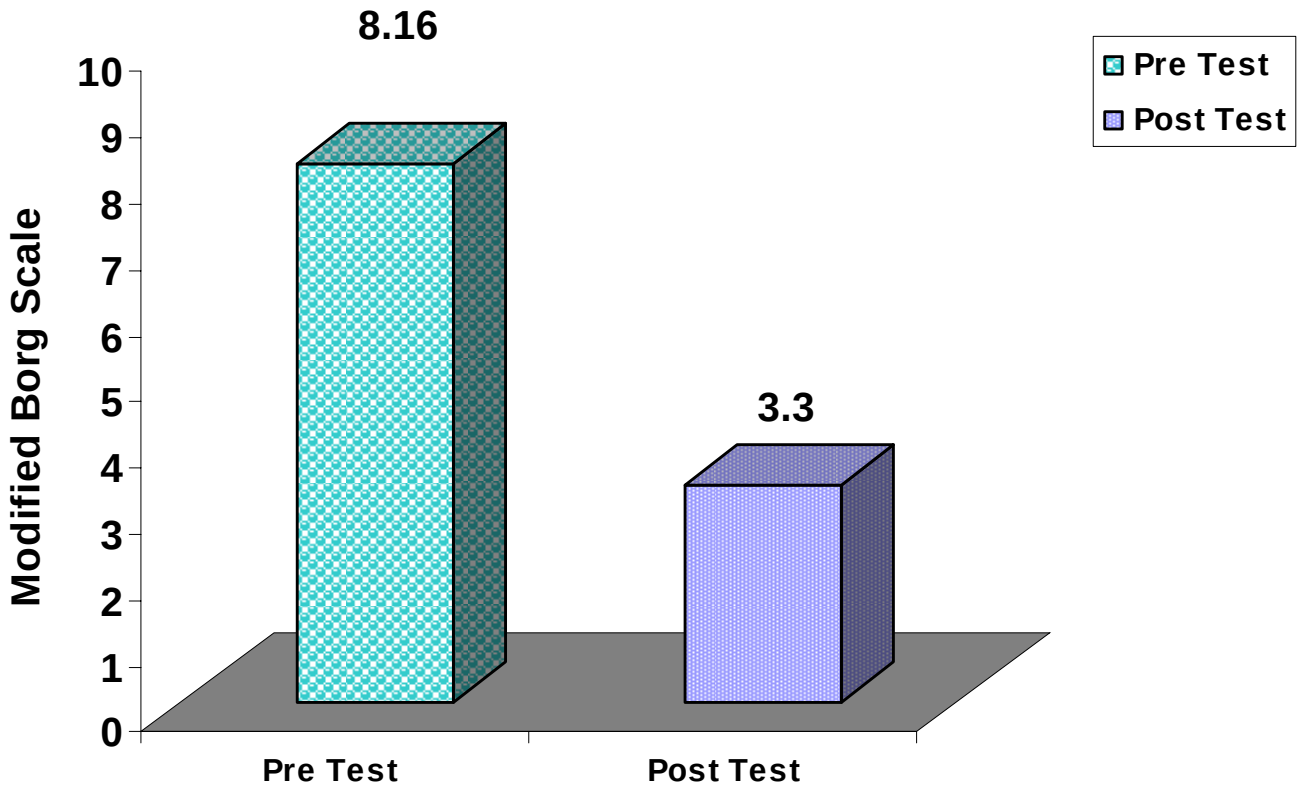
TESTS	**VENTILATORY MUSCLE ENDURANCE TRAINING**	
Experimental group	Pre test mean value	Post test mean value
	8.16	3.3
Paired ‘t’ test	20.32	
P value and its significance	P value < 0.05 and is significant	

For 29 degrees of freedom at 5% level of significance, the student ‘t’ test value for Experimental group was 20.32 and critical value was 2.045, which states that there exists significant difference between the pre test and post test values of Experimental group .

GRAPH-IV

ANALYSIS OF PRE-TEST AND POST-TEST VALUES OF EXPERIMENTAL GROUP

[VENTILATORY MUSCLE ENDURANCE TRAINING]



CHAPTER VI

RESULTS

Effectiveness of control Group (Ventilatory muscle strength training) is elicited by comparing the pre test and post test values of control group using paired ‘t’ test; the calculated value is 14.22 , whereas the critical value is 2.045. Since the calculated value is greater than the critical value, there exists a significant difference between the pretest and post test values of control group. When comparing the mean values of both, the posttest mean value 4.53 is lesser than the pre test mean value 7.86 which confirms that there is a significant improvement in work capacity in COPD patients.

Effectiveness of Experimental group (Ventilatory muscle endurance training) is elicited by comparing the pretest and post test values of experimental group using paired ‘t’ test; the calculated value is 20.32 whereas the critical value is 2.045. Since the calculated value is greater than the critical value, there exists a significant difference between the pretest and post test values of Experimental group . When comparing the mean values of both, the post test mean value 3.3 lesser than the pre test mean value 8.16, which confirms that there is a significant work capacity in COPD patients.

While comparing the post test values of control group and Experimental group using independent ‘t’ test, the calculated value is 3.720 whereas the critical value is 1.960, Since the alternate hypothesis is accepted, which shows that there exists a significant difference between the post test values of two groups. When comparing the mean values of both, the post test mean value of conrol group 4.53 is greater than the post test mean value of Experimental group 3.3 which confirms that Experimental group shows a significant improvement in work capacity than control group .

CHAPTER VII

DISCUSSION

COPD is a progressive disease that primarily affects lungs. One of the common symptoms include dyspnoea. This can lead to self imposed reduction in activity resulting in an even lower threshold for dyspnoea with activity. Therefore, improving work capacity is a key component in management of patients with COPD.

Ventilatory muscle strength training and Ventilatory muscle endurance training are used in this study to improve the work capacity in COPD patients.

Morrison et.al., in their study with COPD patients, concluded that Respiratory muscle endurance training is compromised more than Respiratory muscle strength training which supports the present study on improving work capacity in COPD patientst.al., in their study with COPD patients concluded that Respiratory muscle endurance training is compromised more than Respiratory muscle strength training which supports the present study on improving work capacity in COPD patients.

Diaphragmatic breathing exercise retains the muscles of respiration and improves ventilation by means of loosening the excess bronchial secretions and thereby reducing the accessory muscle work.

Prabhu et al.,1990 stated that it increases the diffusion thereby reducing dyspnoea. Pursed lip breathing is thought to keep airways open by creating a backpressure in the airways and is helpful in COPD patients with a deal of dyspnoea.

Carolyn kisner and Lynn allen Colby suggested that it reduces the respiratory rate, increases tidal volume, improves exercise capacity, increases oxygen saturation.

Gosselin et.al., 1995 stated that diaphragmatic breathing exercise despite theory increased sensational dyspnoea, asynchrony of chest wall and reduced mechanical efficiency with COPD patients.

With the support of recent past evidences, the present study also proves that Ventilatory muscle endurance training is more significant on improving the work capacity in COPD patients. Hence ,Ventilatory muscle endurance training may be helpful on improving the work capacity in COPD patients.

CHAPTER VIII

SUMMARY AND CONCLUSION

SUMMARY

The objective of the study is to find out the effectiveness of Ventilatory muscle strength training with Ventilatory muscle endurance training on improving work capacity in COPD patients , 60 patients were selected using purposive random sampling technique and assigned into two control and experimental groups with 30 subjects each.

control group was treated with Ventilatory muscle strength training and Experimental group was treated with Ventilatory muscle endurance training for a period of 4 weeks

The results were analysed using student ‘t’ test, which favoured the alternate hypothesis.

CONCLUSION

It can be concluded that Ventilatory muscle endurance training shows significant improvement than Ventilatory muscle strength training on improving work capacity in COPD patients.

CHAPTER IX

LIMITATIONS AND SUGGESTIONS

- This study was very short term study and therefore to make the result more valid, a long term study should be done.
- This study has been done with smaller sample and hence further studies should be conducted with large sample.
- The present study is performed with Ventilatory muscle strength training and Ventilatory muscle endurance training on improving work capacity in COPD. In the future, technique such as active control of breathing technique (ACBT) can be applied.
- This study should be analyzed using various other scales like MRC Breathlessness scale, Dyspnoea index etc.,
- Variation in calamite, drugs, diet, personal habit, side of involvement, gender, age could not be controlled.
- This technique produces short-term benefits in patients with COPD and should be investigated further.

CHAPTER X

BIBLIOGRAPHY

1. Alexandra Hough , *Physiotherapy in respiratory care,3/e,2001,*Nelson Thornas publications.
2. Alagappan R, *Manual of practical medicine,*2/e,2002,Jaypee
3. American Thoracic Society, Dyspnea: mechanisms, assessment, and management: a consensus statement. *Am J Respir Crit Care Med* 1999;159:321–340.
4. Ann Thomson, Skinner, *Tidy's Physiotherapy,* 12/e, Nanghese Publishing House
5. Barbara A Webber, Jennifer A Pryor, *Physiotherapy for respiratory and cardiac problems,* 1993, Churchill Livingstone.
6. Cahalin, *Journal of cardiopulmonary rehabilitation*, 2002
7. Carolyn M Hicks, *Research for Physiotherapist-Project Design and Analysis, 2/e,* 1995, Churchill Livingstone.
8. Carolyn kisner and Lynn allen Colby,*Therapeutic exercise, 4/e,2003,*Jaypee
9. Christopher Haslett, Edwin R Chives, *Davidson's Principles and Practice of Medicine, 18/e,* Churchill Livingstone.
10. Dena Gardiner.M, *Principles of exercise therapy*, 4/e,2000, CBS
11. D.V.Gaskill, Barbara A Webber, *The Brompton hospital guide to chest physiotherapy, 4/e,* Blackwell Scientific publications.
12. Elizabeth Dean, *Principles and Practice of cardiopulmonary Physical Therapy,4/e,2006,* Mosby publications.

13. Elizabeth Domholdt, *PT Research Principles and Applications*, 2/e, 2000, WB Saunders company.
14. Gupta.S.P, *Statistical methods,28/e,2000,* Sultan Chand and sons New Delhi.
15. Harrison, *Principles of internal medicine*,4/e,1962,Mc Graw Hill.
16. Joanne Watchie, *Cardiopulmonary Physical Therapy,* 1/e, 1995, WB Saunders company.
17. K.Sembulingam and Prema Sembulingam, *Essentials of Medical Physiology, 3/e, 2005,* Jaypee Brothers.
18. Kothari CR ,*Research methodology,2/e,* 1990,Wishwa Prakashan, New Delhi.
19. Lisboa C, Villafranca C, LeivaA, Cruz E, Pertuze J, Borzone G, Inspiratory muscle training in chronic airflow limitation: effect on exercise performance. Eur Respir J 10: 537-542, 1997.
20. LR Potti, *A Textbook of statistics.*
21. Patricia A Downie, *Cash textbook of Chest, Heart and Vascular disorders for Physiotherapists*, 4/e, Jaypee brothers.
22. Parveen kumar, *Text book of clinical medicine*,3/e,1994,ELBS
23. Richards DW Jr., The Lewis A. Conner memorial lecture: the nature of cardiac and of pulmonary dyspnea.*Circulation* 1953;7:15–29.[Medline]
24. Scott Irwin, John Stephen Techlin, *Cardiopulmonary Physical Therapy*, 3/e, 1995, Mosby publications.
25. Susan B O Sullivan, Thomas J Schmitz, *Physical Rehabilitation,5/e,*2006,Jaypee Brothers.

CHAPTER XI

APPENDIX – I

CASE ASSESSMENT PROFORMA

CASE NO :

NAME :

SEX :

ADDRESS :

DATE OF ADMISSION :

DATE OF EVALUATION :

HISTORY :

ON OBSERVATION :

ON EXAMINATION :

TREATMENT :

MEASUREMENT TOOL : Modified Borg scale

S.NO.	PRE TEST	POST TEST

Signature of physical therapy student

APPENDIX – II

PATIENT CONSENT FORM

TITLE: "A COMPARATIVE STUDY ON EFFICACY OF VENTILATORY MUSCLE STRENGTH TRAINING AND VENTILATORY MUSCLE ENDURANCE TRAINING ON IMPROVING WORK CAPACITY IN COPD PATIENTS".

INVESTIGATOR: _ _ _ _ _ _ _ _ _ _ _

PURPOSE OF THE STUDY:

I_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ ,have been informed that this study will work towards improving work capacity in COPD patients.

PROCEDURE:

Each term of the study protocol has been explained to me in detail. I understand that during the procedure, I will be receiving the treatment for one time a day. I understand that I will have to take this treatment for four weeks.

I understand that this will be done under investigator, _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ supervision. I am aware also that I have to follow therapist's instructions as has been told to me.

CONFIDENTIALITY:

I understand that medical information provided by this study will be confidential. If the data are used for publication in the medical literature or for teaching purposes, no names will be used and other literature such as audio or video tapes will be used only with permission.

RISK AND DISCOMFORT:

I understand that there are no potential risks associated with this procedure, and understand that investigator will accompany me during this procedure. There are no known hazards associated with this procedure.

REFUSAL OR WITHDRAWL OF PARICIPATION:

I understand that the decision my participation is wholly voluntary and I may refuse participate, may withdraw consent at any time during the study.

I also understand that the investigator may terminate my participation in the study at anytime after researcher has explained me the reasons to do so.

I …….. have explained to ……. the purpose of the research, the procedures required and the possible risks and benefits, to the best of my ability.

…… ……

investigator Date

I ……. Confirm that researcher has explained me the purpose of the research, the study procedure and the possible risks and benefits that I may experience. I have read and I have understood this consent to participate as a subject in this research project.

…….. ……

Subject Date

…….. …….

Signature of the Witness Date

APPENDIX III

MODIFIED BORG SCALE

SCORE	RATE OF PERCEIVED EXERTION
0	Nothing at all
0.5	Very, very slight
1	Very slight
2	Slight
3	Moderate
4	Somewhat severe
5	Severe
6	
7	Very severe
8	Very, very severe
9	Maximal
10	